Understanding Tilt-in-Space Use in Shepherd Center Clients

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Shepherd Center In-service

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What DO we know about Tilt-in-Space?

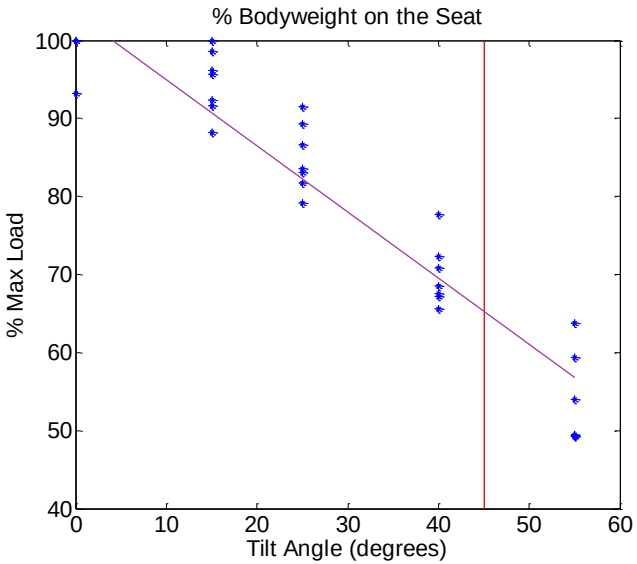
- Seating clinic prescribed >100 in 2007
- Expensive
- Justification – lack of ability to independently reposition or do weight shifts (pressure ulcer prevention)
- Increasing tilt angle decreases interface pressure

What DON'T we know about Tilt-in-Space

- How often it is used for pressure relief
- Whether or not people know how to use it for pressure relief
- How much physiological benefit one gets from a tilt
- What other reasons people use their tilt

How far to tilt?

- Studies say interface pressure decreases as tilt angle increases.
- Is 45º magic???
- Chris Maurer presented this graph at ISS 2007:
- Many clinicians teach 45º or "all the way back"
  - more is better, even without magic angle
- Literature varies between > 30º and up to 45º



Lacoste, M., R. Weiss-Lambrou, et al. (2003). Assist Technol **15**(1): 58-68.

Purposes for Tilting

- Decreased pressure
- increased comfort and sitting tolerance secondary to the decreased pressure
- increased function
  - secondary to increased sitting tolerance and more time out of bed
  - variable positions available for access and reach in different situations
  - improved head and neck control
  - easier transfers
- increased blood flow
- easier feeding
- improved respiratory function
- improved sleep and rest

Lacoste et al: A Survey about Tilt and Recline

- 40 people
- how and why they used their systems
  - comfort/discomfort/pain
  - rest/relaxation
  - posture
  - functional independence
  - physiological functions (including pressure reliefs)
- 97.5% reported using their tilt or recline system daily
- > 70% used their tilt and recline systems for comfort, rest, relaxation, and pain
- few participants reported using the chairs for prevention of pressure sores or other physiological functions.

Lacoste M, Weiss-Lambrou R, Allard M, Dansereau J. Powered tilt/recline systems: why and how are they used? Assist Technol 2003;15(1):58-68.

Purpose of Tilt-in-Space Monitoring Study

- To explore how fulltime power wheelchair users utilized their tilt systems.
  - Did participants utilize their tilt feature?
  - Did participants perform regular weight shifts?
  - Why do people use their tilt?
  - Do people with different purposes for tilting use their tilt systems differently?

Methods: Subjects and Protocol

- Convenience sample: N=16 (11 men, 5 women),
- Fulltime power wheelchair users
- Varying diagnoses
- 2 weeks of monitoring
- WhAMI (Wheelchair Activity Monitoring Instrument)
  - Occupancy switches
  - Accelerometer for tilt angle
  - Record every 2 seconds
- Asked (n=15) why or when they use tilt (open ended)

Methods: Variables

- Occupancy Time
- % Occupancy time at each position
  Small < 15º; Medium 15-29º;
  Large 30-44º; Extreme >45º
- Tilt
  - Reflects use of tilt feature
  - Position change of 5º in either direction lasting ≥ 20 seconds
- Pressure Relieving Tilt (PRT)
  - Backwards tilt to a position > 30º lasting ≥ 1 minute
- Tilt Frequency (either tilt or PRT)
  - # tilts on a day / occupancy time on the same day, reported in tilts per hour

Results: Occupancy Time

- Median = 11.0 hours per day
- range: 5.0-16.6 hours
- 6 subjects spent >12 hours per day in wheelchair

Results: Breakdown of Day

- 5 Subjects (yellow) spent most of their time upright.
- Only 6 subjects (blue) tilted to 45º
- Some subjects never reached 30º
- Some subjects spent most of their time between 15º and 30º

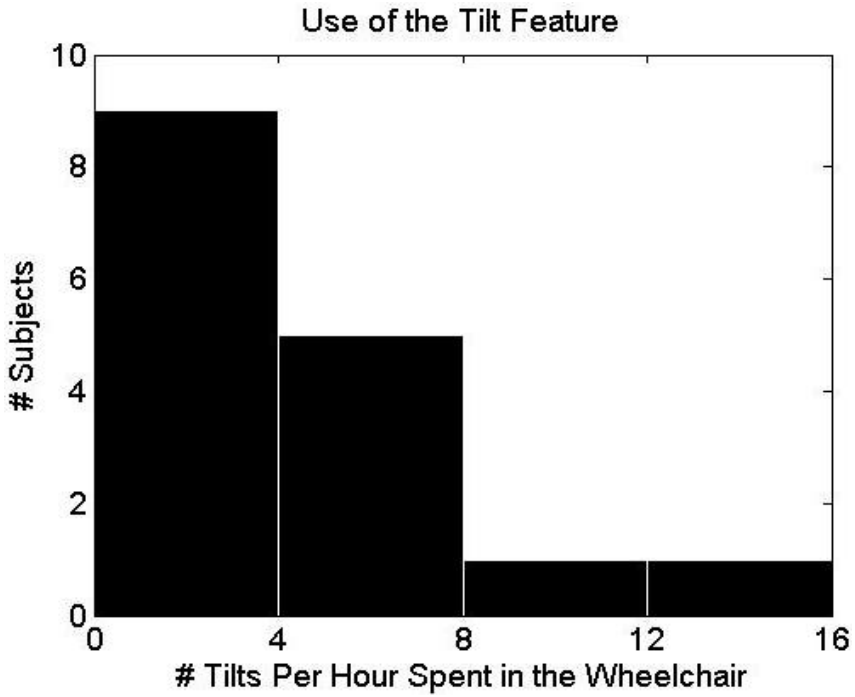
Subject	% of Time in Wheelchair			
	< 15°	15°-29°	30°-44°	≥ 45°
1	91%	5%	2%	2%
2	93%	6%	0%	0%
3	98%	1%	1%	0%
4	98%	2%	0%	0%
5	100%	0%	0%	0%
6	25%	67%	8%	0%
7	36%	63%	0%	0%
8	37%	61%	3%	0%
9	39%	58%	2%	1%
10	19%	52%	29%	0%
11	28%	42%	30%	1%
12	54%	26%	6%	14%
13	70%	9%	21%	0%
14	80%	6%	13%	1%
15	84%	5%	9%	3%
16	84%	16%	0%	0%

Results: Use of Tilt Feature

- Recall:

  Tilt = a change of 5º for 20 seconds
- Nearly half of subjects tilted regularly

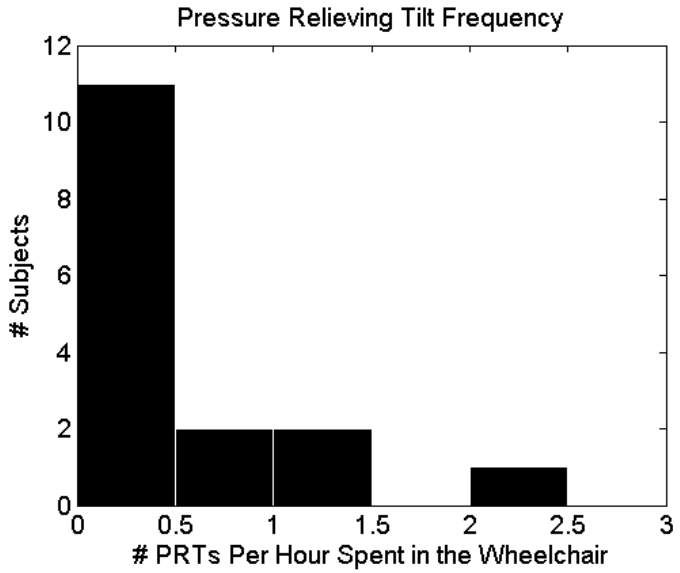
  (1 x / 15 minutes)



Results: PRT Frequency

- Recall:

  PRT = tilt > 30º for 1 minute
- Median subject = 1 pressure relieving tilt every 7 hours
- Only 3 subjects performed pressure relieving tilts at least once per hour.



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Discussion

- Did participants utilize the tilt feature?
  - Most subjects (15/16) utilized their tilt feature
  - Frequent, small position changes (4/hour)
  - Most subjects sat at more than 2 different positions throughout the day
  - Diverse types or styles of use
- Did participants perform regular weight shifts?
  - No!
  - Little to no tilting to 45º
  - Infrequent tilting past 30º

Discussion: Questions Raised

- What benefits are people getting from small to medium sized tilts (<30º)?
- How can we predict who will take advantage of their tilt system?
- Why do so few people perform pressure relieving tilts with the recommended frequency?
  - What can we do to encourage people to tilt to 45º more frequently??
- Why do few subjects tilt to 45º ?
  - What can we do to encourage more people to tilt as far back as 45º or greater?
- Are we training people properly to utilize tilt (frequency and magnitude) as clinicians intend?

Purpose of Tilt Use

Subject	Comfort / Discomfort / Pain	Rest / Relaxation	Posture	Functional Independence	Physiological Functions
1	X				X
2	X		X		X
3	X			X	
4	X				X
5	X		X	X	
6	X			X	
7	X	X			X
8	X	X			
9		X	X	X	X
10		X			X
11		X			X
12		X	X		X
13		X		X	X
14		X			X
15					X

Median Tilt Use By Purpose

	Comfort/Discomfort/Pain		
	No (6)	Yes (9)	p-val
Typical Position ( )	7	15	0.290
Tilt Frequency / hour of wheelchair occupancy	4.9	2.8	0.178
PRT Frequency / hour of wheelchair occupancy	0.6	0.1	0.194
% Time > 30	12%	3%	0.194
	Rest/Relaxation		
	No (7)	Yes (8)	p-val
Typical Position ( )	15	6	0.102
Tilt Frequency / hour of wheelchair occupancy	4.2	1.6	0.248
PRT Frequency / hour of wheelchair occupancy	0.2	0.1	0.211
% Time > 30	5%	3%	0.441

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Tilt use when used for physiological purposes including pressure reliefs

	Physiological		
	No (4)	Yes (11)	p-val
Typical Position ( )	15	8	0.461
Tilt Frequency / hour of wheelchair occupancy	2.8	3.2	0.292
Pressure Relieving Tilt Frequency / hour of wheelchair occupancy	0.1	0.3	0.598
% Time > 30	3%	4%	0.673

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Comparison with Lacoste et al.'s Survey Results

SIMILARITIES

- 14/15 subjects reported comfort, pain, or rest as a purpose of use

DIFFERENCES

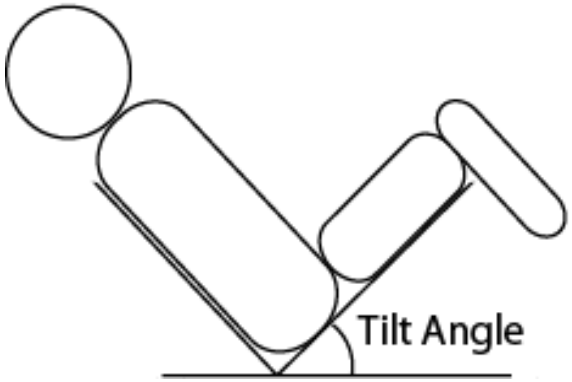
- Many participants reported physiological purposes
- Many participants had at least one day in which they did not use their tilt feature to change position more than 5º.

Purpose of the Tilt Angle Pilot Study

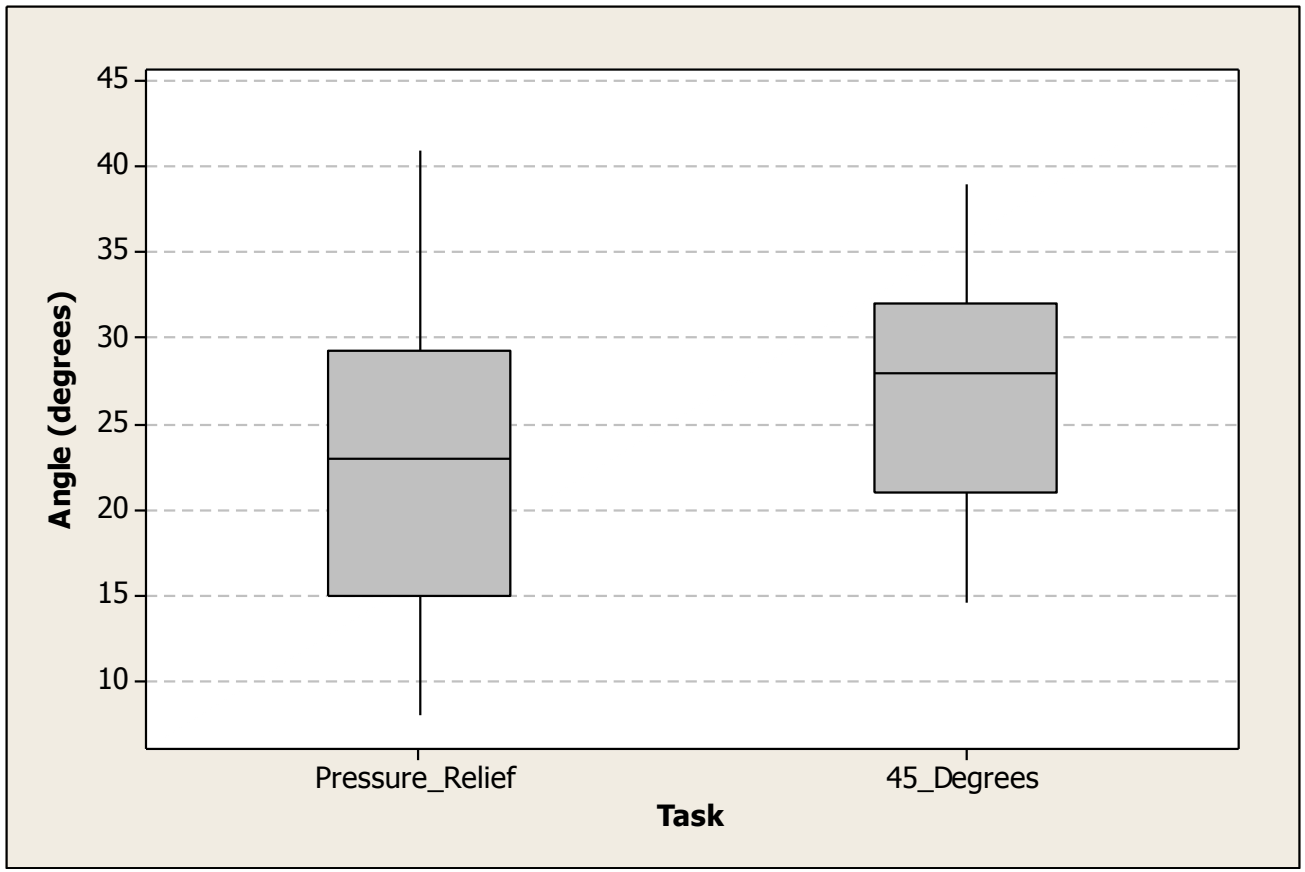
- Tilt Angle Pilot Study: To determine if people know how far to tilt for pressure reliefs
  - Do people know how far to tilt for pressure relief?
  - Are people aware of how far they are tilted?
  - Does training help?

Able-bodied Students "Novice Users"

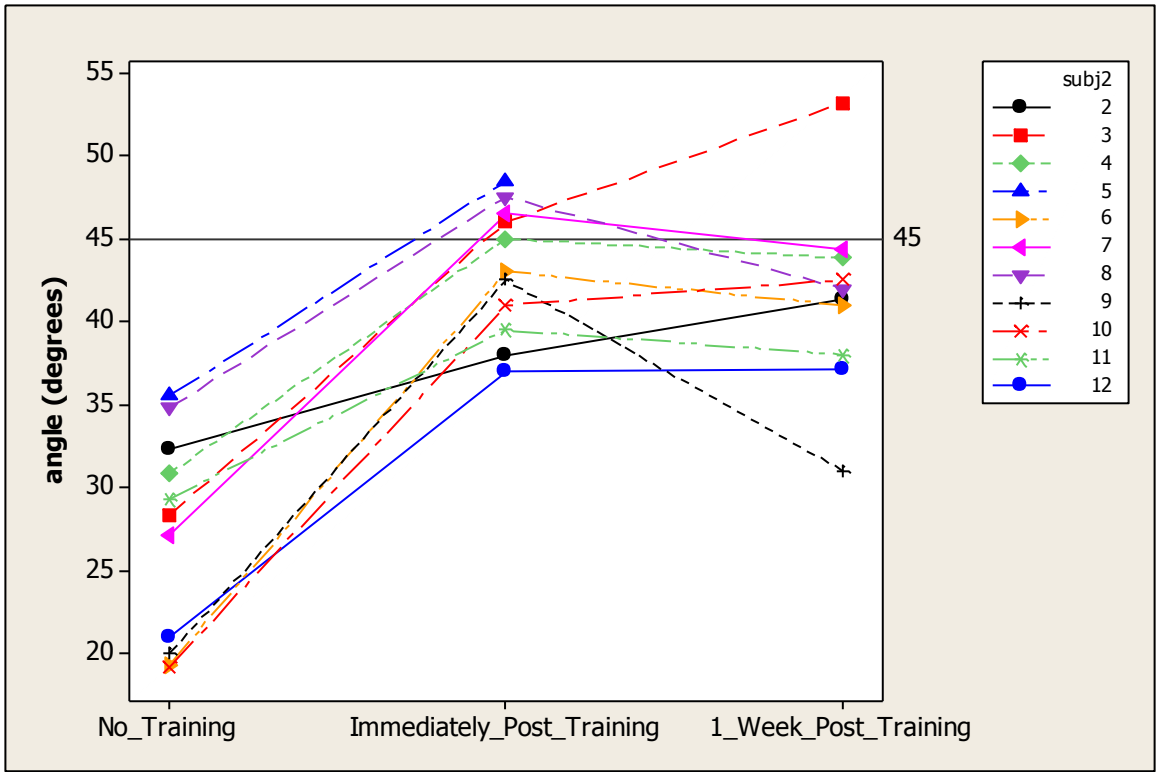
- N = 11 able bodied students
- Adjusted footrests on a tilt-in-space power wheelchair for optimal fit
- Asked to tilt "as far as needed for pressure relief", measure actual angle (x3)
- Asked to tilt to 45º, measure actual angle (x3)
- Shown 45º of tilt and asked to replicate the position, measure actual angle
- 1 week later – ask subjects to tilt to 45º



Able-bodied Students: Before Training

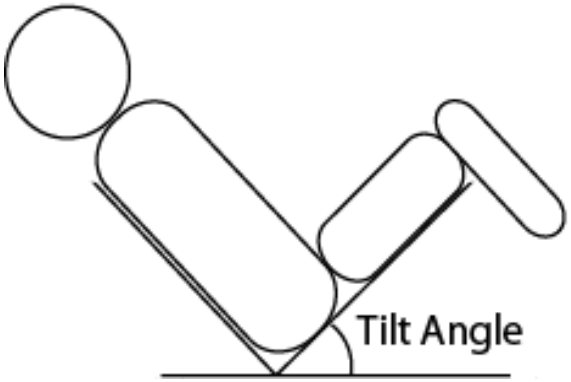


Able-bodied Students: Training Effects



Current Tilt Users

- Randomly selected people who use powered tilt wheelchairs were asked to "demonstrate a pressure relief" 3 times
- Angle with horizon was measured



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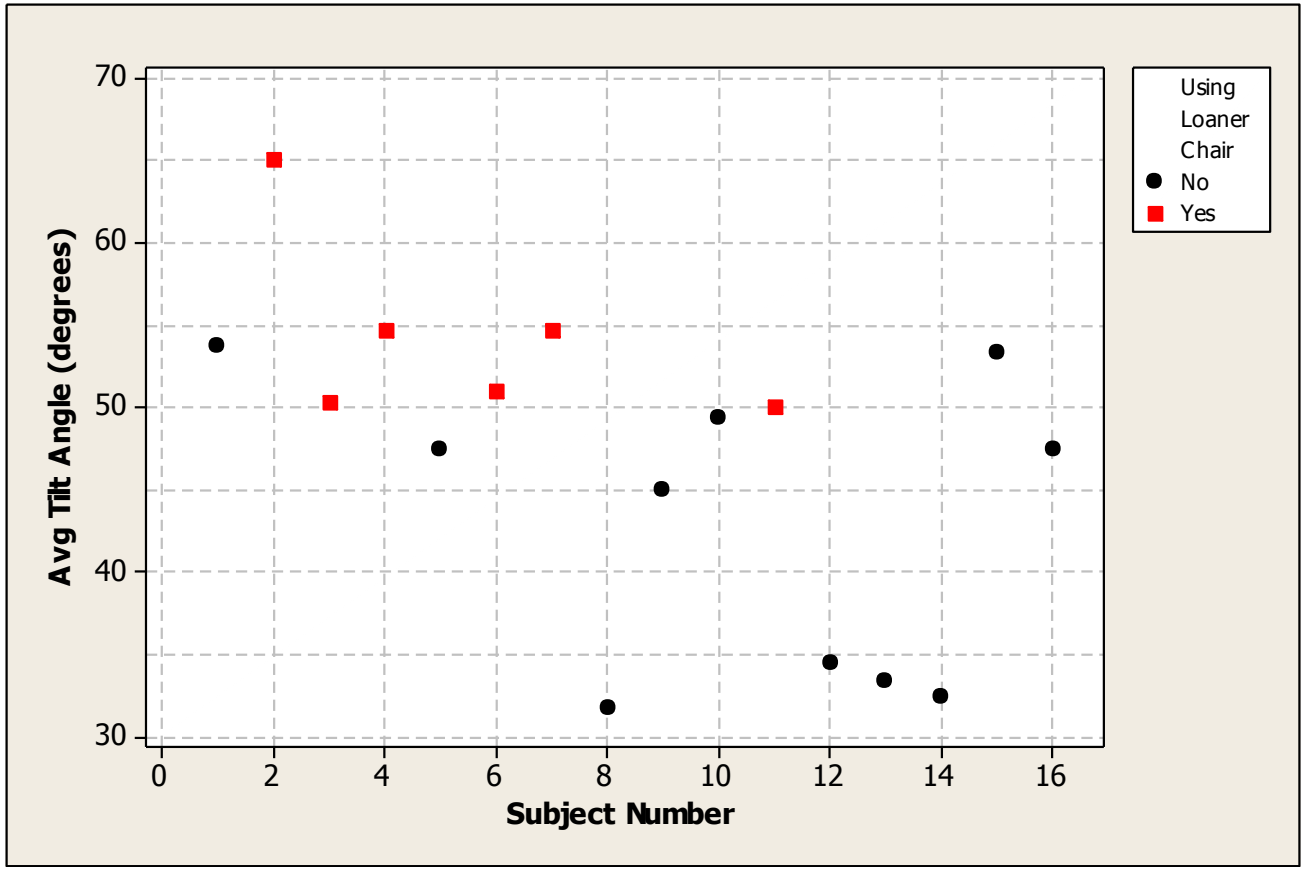
Current Tilt Users



Discussion

Monitoring Study

- Do frequent, small position changes offer restorative benefits to wheelchair users?
- How can we predict who will take advantage of their tilt system?

Tilt Angle Study

- How can we improve training to make sure everyone knows how far to tilt?
- What sort of follow-up can we provide to improve retention of knowledge about tilts and pressure reliefs?
- If training successfully teaches people how far to tilt, why are some people still not tilting?

What now?

- Monitor more people
  - Is pressure relieving tilt frequency low across more people?
  - Does a person's knowledge of how far to tilt relate to whether or not they tilt?
  - Does more frequent tilting relate to improved health?
- Study blood flow
  - Do small tilts increase blood flow at all?
  - What is the smallest tilt needed to produce a hyperaemic response?
- Graduate

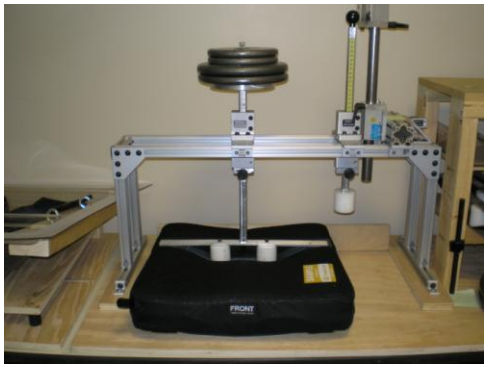
How will I do all of this and be able to graduate next year?

Monitoring more people and studying blood flow might take up to 50 participants... I need your help!

- Tell your patients about ongoing research.
- Encourage them to learn about the studies and consider participating.
- Give out my email address (sharon.sonenblum@coa.gatech.edu)
- Encourage people to join the CCN (www.catea.org >> click on “Join the CCN”)

Other Applied Clinical Research at Shepherd Center: Ongoing

- Manual Wheelchair Monitoring
- Cushion Degradation Study determine the functional lifespan of wheelchair cushions used in typical daily fashion
  1. verify or negate the 5 year expected lifespan for durable medical equipment (DME)
  2. identify critical factors contributing to or accelerating degradation
  3. develop a simple and comprehensive test to assist clinicians and users with the decision of replacement



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Other Applied Clinical Research at Shepherd Center: Ongoing

- Dartfish - Real-time video feedback
  - investigate the use of real-time video feedback to improve training on mobility and activity of daily living (ADL) related skills that are commonly taught during therapeutic rehabilitation.

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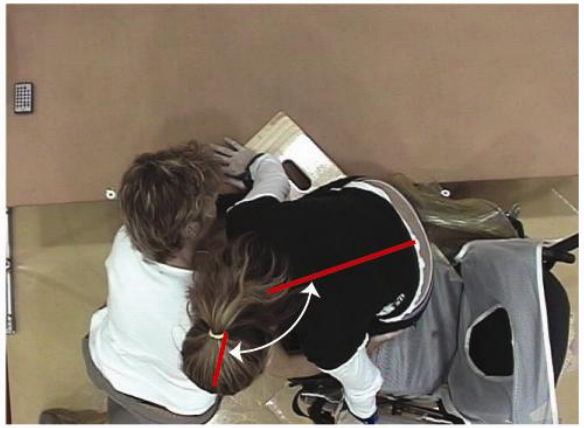
Wheelchair Transfer

Before Real-time Video feedback

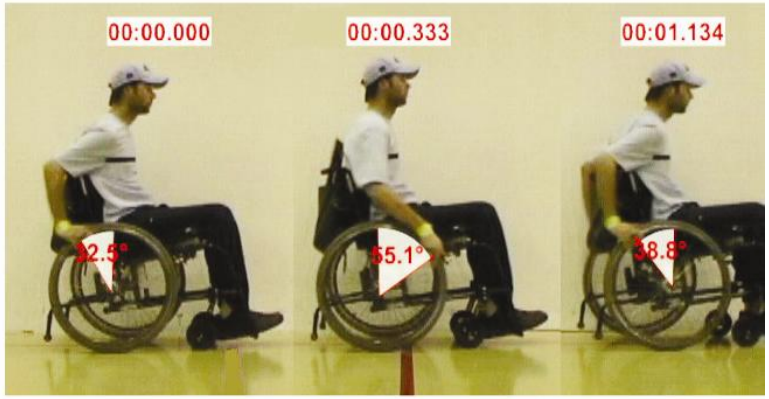
After Real-time Video feedback



Wheelchair Propulsion

Before Real-time Video feedback

After Real-time Video feedback



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Other Applied Clinical Research at Shepherd Center: Upcoming

- Pressure ulcer risk analysis
  - Do clinical risk factors change blood flow occlusion or tissue stiffness at the IT?
- Pressure relief monitoring in manual wheelchair users
  - Do people with a history of recurrent pressure ulcers have different pressure relief behaviors than people without a history?

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  - Kim Davis
  - Christy Acker
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  - Brian Dunlap

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Questions?
Ideas for research projects?
Ways to improve tilt use?

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